

peated stress. The crystals are broken under repeated stress. The second theory, advanced by Bauschinger, the German scientist, is that under repeated stress some inherent property of the material changes its elastic limit, it is an inherent property of the material, possibly some property of the amorphous cement between the crystals. The third view is that all fatigue of metals is the result of the spread of damage from little localized over stresses.

I do not feel justified in stating my positive belief in the third view as against the second, but I have yet to run across a case of failure of steel or other metal, either in the laboratory or in service that could not be explained by the gradual spread of damage from some nucleus.

In the steel work of any building there are undoubtedly many thousands of places where structural damage was done—where riveted members were bent into place cold and where the rivets were fitted with drift pins and things of that kind. locally, the steel in the building was stressed beyond its yield points in many places. These little localized over stresses do

no damage at all; the building is entirely safe. But if this building were subjected eight or ten times a day to a mild earthquake, these little localized over stresses might be nuclei from which damage would spread and eventually we would have trouble. That is, these little localized over stresses may not be important if the structure is loaded a few times but they may be of importance if the structure is loaded many thousands of times.

So far we have seen no failure that could not be explained by localized high stress, at a nick, a crack, at a point where one heat treatment stopped and another began or where there was local faulting due to that fact, possibly due to a place where there was local blue brittleness—or any one of a dozen causes. Certainly in the case of drill rods the actual distribution of stress must be different from that which any mathematical analysis could predict. It would seem that the spread of damage from the localized over stresses, so far as we can see now, explains the phenomenon known as fatigue.—Abstract of paper presented at the New York Meeting, February, 1921.

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